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B5A
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(54) Extruding discrete foodstuff pieces

(57) Food shaping apparatus for severing extruded bulk foodstuff such as ice-cream into individual pieces e.g. generally spherical, or conical, comprises a conduit 1 which receives a flow of ice-cream and which has an outlet 2 mounting therewithin severing means in the form of for example a reciprocable iris 3. Pressure varying means in the form of a piston 18 mounted within a cylinder 17 communicates with the conduit and is actuable in synchronism with the severing means to produce pressure variations effective periodically to vary the flow rate of ice-cream through the utlet duct.

The synchronism is effected via a cam (23), provided in a rotated member (12) which drives a crank which operates the iris (3). The extruded piece may comprise two ice cream flavours or col urs i.e. a piece in which one colour completely surrounds the other.

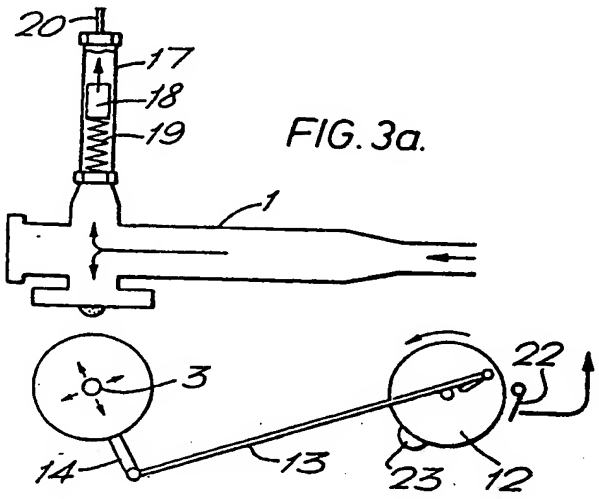

FIG. 3a.

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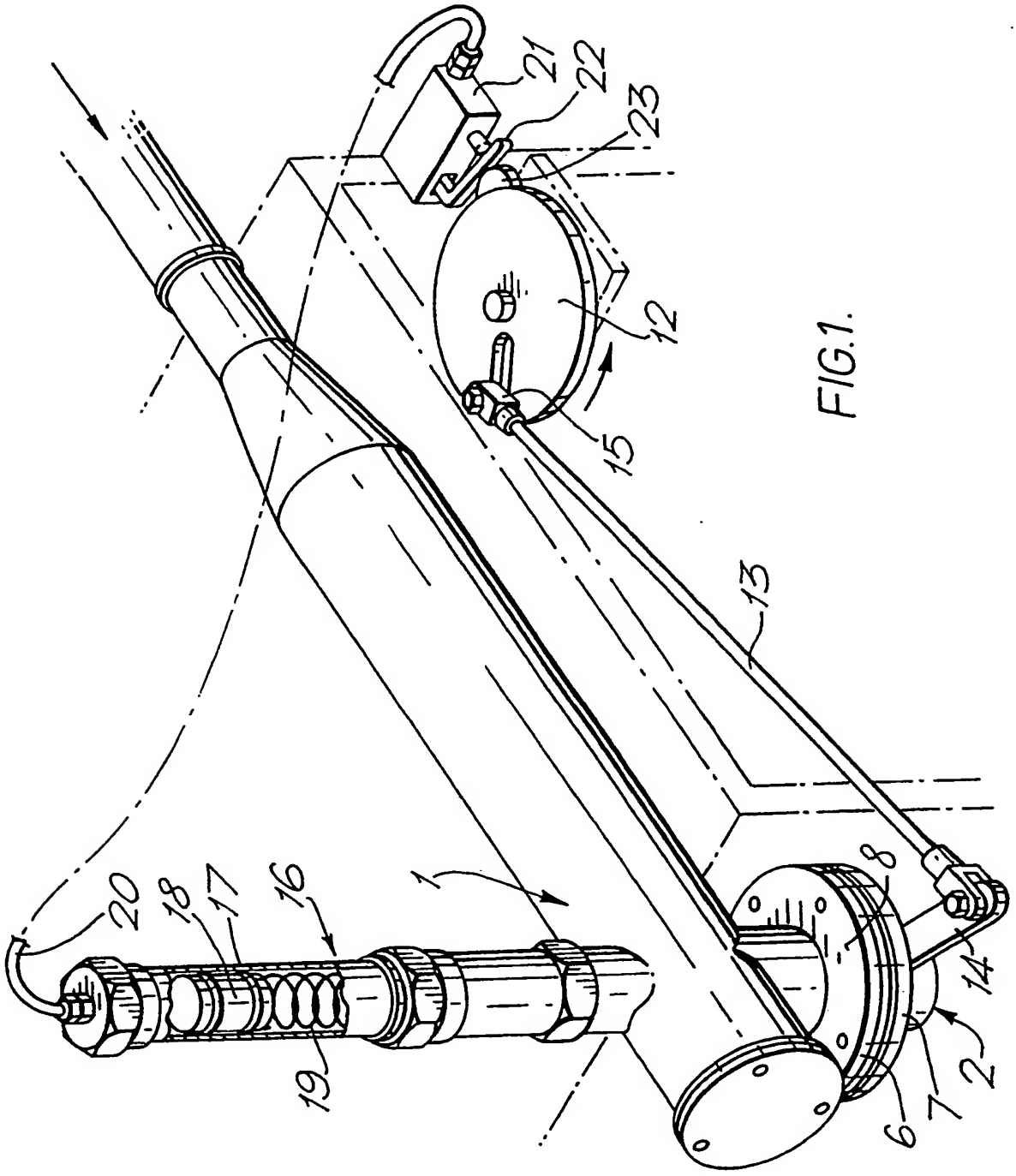

FIG.1.

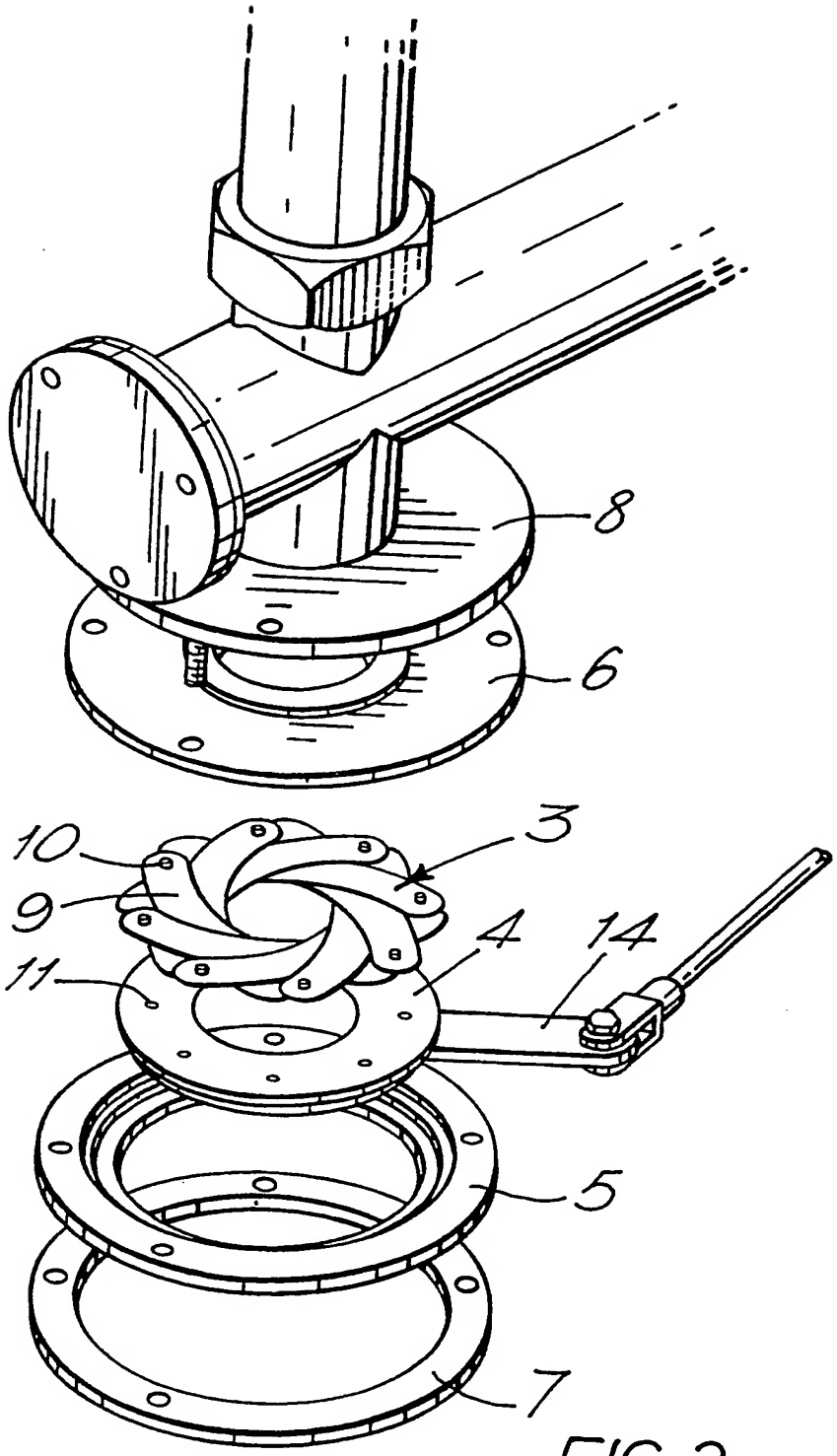

FIG. 2.

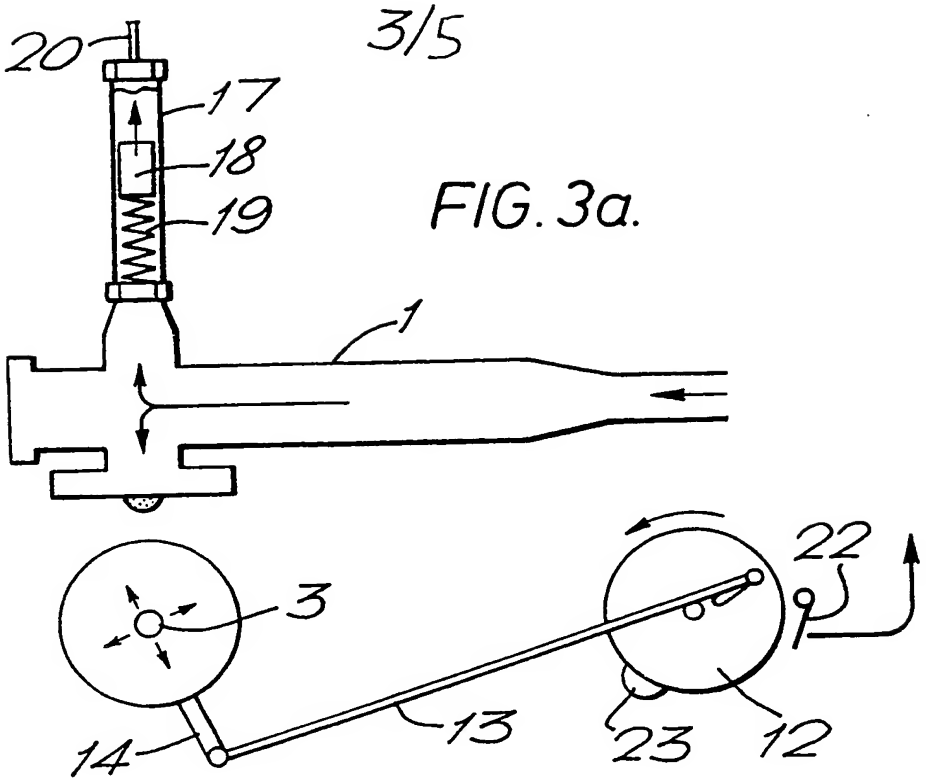

FIG. 3a.

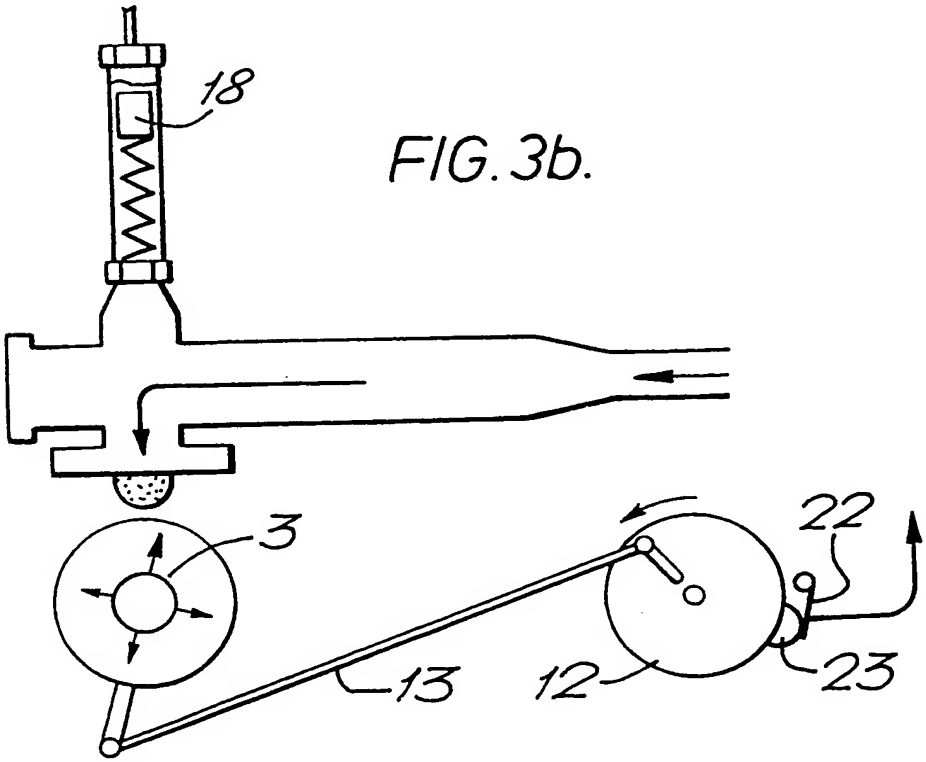

FIG. 3b.

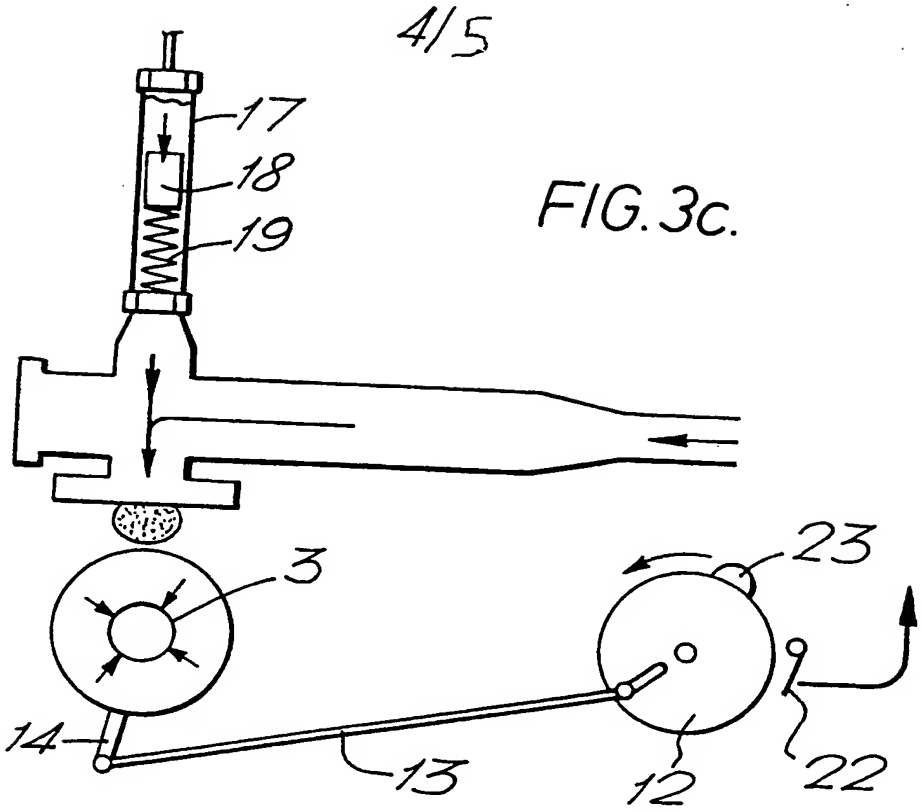

FIG. 3c.

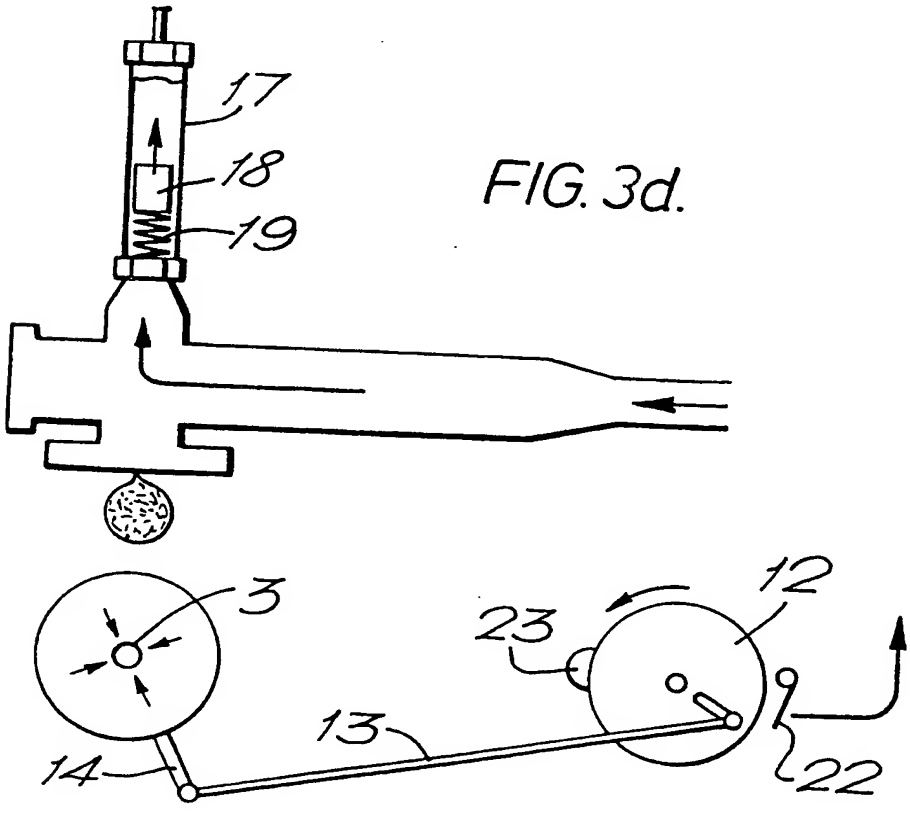

FIG. 3d.

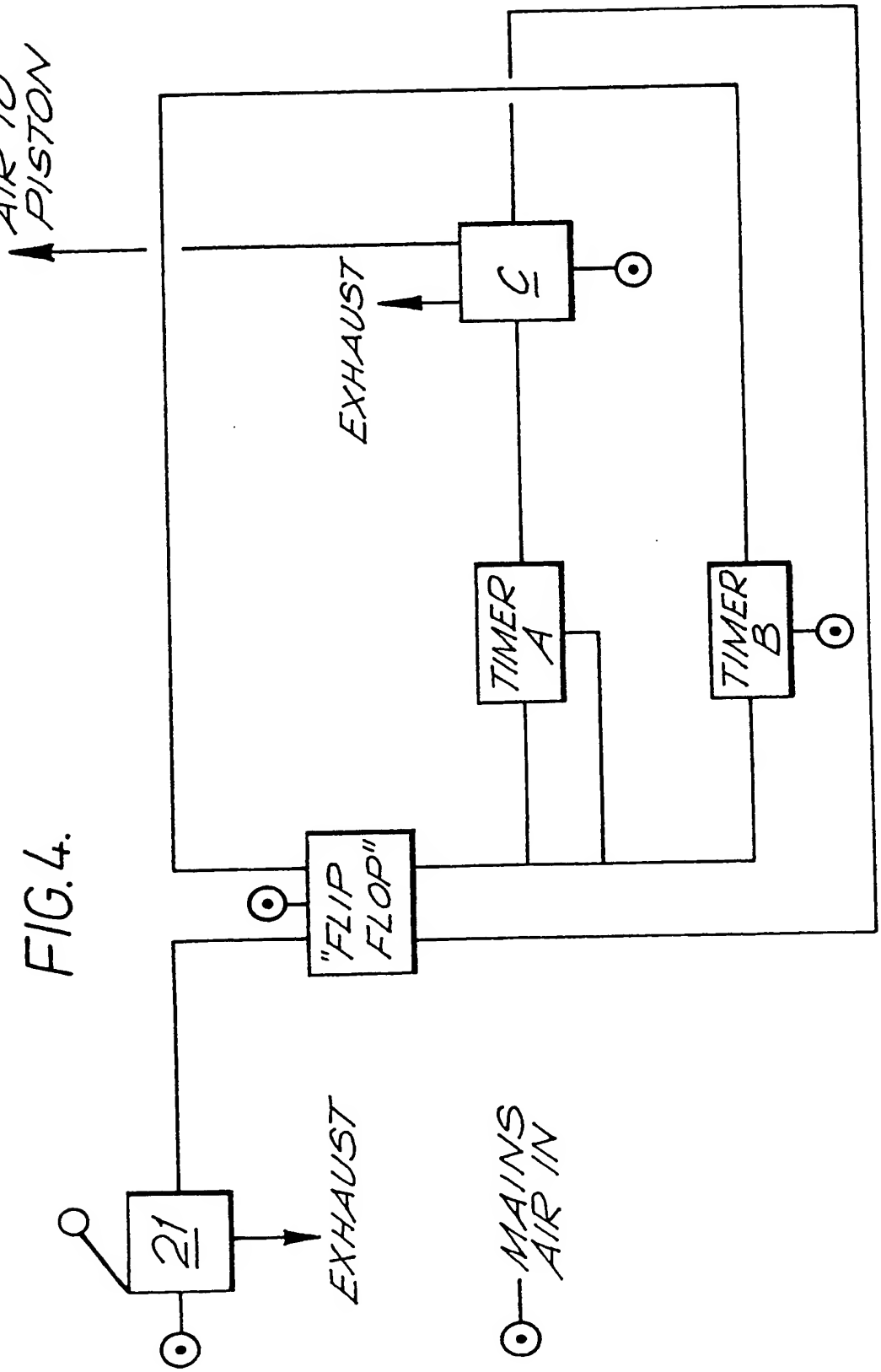

FIG. 4.

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SPECIFICATION

Food processing apparatus

This invention relates to food processing apparatus and relates in particular to apparatus for fabricating ice cream, or other bulk foodstuffs of similar consistency to ice cream, into discrete pieces thereof having a desired general shape.

One known form of apparatus for fabricating bulk foodstuffs into individual pieces comprises a reciprocable severing member in the form of a closable diaphragm or iris, located in or adjacent the outlet of a conduit through which the food material is pumped under pressure from a suitable source or reservoir, the severing member being actuable so as to form the material into discrete pieces thereof. Such apparatus has been used in the mechanised automated production of meat balls.

A drawback with known apparatus of this type is however that in some instances a particular desired general shape of the resulting individual pieces cannot easily be obtained. For example, where the food material supplied to the iris is of a compressible nature or where the flow of food material supplied to the iris is a substantially continuous one of constant pressure, generally spherical pieces will not be provided if the iris is reciprocated between its fully open and closed positions with substantially constant speed. In the manufacture of meat balls, this problem does not arise since meat paste is non-compressible and in standard supply systems the flow of meat paste is typically pulsed and it is therefore possible to synchronise the opening and closing of the iris with the pressure increases and decreases of the supply of material in such a way that substantially spherical pieces are produced. However, in the manufacture of ice cream, for example, a standard source produces an extruded ice cream of compressible nature with a flow of substantially constant pressure. In this case, with the known apparatus discussed above, substantially spherical pieces can only be produced by appropriately controlling the speed of the iris during its operating cycle so that the dwell time in the open condition is increased relative to that in the closed condition. However, this presents mechanical difficulties as regards the drive mechanism for the iris and furthermore it is difficult with this approach to provide flexibility whereby the apparatus is also capable of producing pieces of different desired shapes and sizes over a range of ice cream supply flow rates.

Viewed from one aspect the present invention provides food processing apparatus comprising a conduit arranged in use to receive a flow of bulk foodstuff, such conduit communicating with an outlet duct in or adjacent which is located severing means operable to form the foodstuff passing through the outlet duct into individual pieces thereof, the apparatus further comprising a pressure varying device communicating with the conduit in the region of the outlet duct, such device being actuable in synchronism with the severing means to produce pressure variations within the conduit which are effective periodically to vary the flow rate of foodstuff through the outlet duct.

Apparatus according to the invention is capable of providing individual pieces of desired shapes which could not previously be obtained under certain operating conditions. For example, in the case discussed above where it is desired to produce substantially spherical ice cream pieces, the pressure varying device may be synchronised with the severing means, which in this case comprises a closable diaphragm or iris, in such a way that the pressure in the region of the conduit adjacent the outlet duct is relatively increased when the iris is in or adjacent a fully open condition thereof, and conversely the pressure is relatively reduced during such time as the iris is in or adjacent its fully constricted condition. This causes a corresponding variation in the quantity of foodstuff forced through the iris, and by actuating the pressure varying device to provide appropriately timed pressure variations of suitable magnitude it is thus possible to form substantially spherical pieces.

Moreover, apparatus in accordance with the invention is flexible in that other segment shapes may be obtained. For example, generally cone shaped pieces are produced if the pressure varying device is operated to cause a relative increase in pressure during such time as the severing means approaches its fully closed condition. Other modes of operation may also be envisaged.

The pressure varying device in apparatus in accordance with the invention may comprise any suitable means capable of producing the required pressure variations within the conduit in synchronism with the operation of the severing means. Thus, for example the device could include a flexible diaphragm which is displacable inwardly to produce a relative pressure increase within the conduit and which is relaxed to produce a pressure decrease. In a preferred embodiment, however, the pressure varying device comprises a cylinder communicating with the conduit which mounts therewithin a reciprocable piston, movements of which are effective to produce the required pressure variations within the region of the conduit adjacent the outlet duct. In a preferred such arrangement, which is particularly suitable for producing substantially spherical ice cream pieces, the conduit includes a downwardly directed outlet duct whereby the resulting pieces fall therefrom under the influence of gravity, and the pressure varying device is located opposite, i.e. above, the outlet duct, the piston being arranged for vertical movements so that the downstroke thereof produces a downward thrust of foodstuff towards the outlet conduit.

In a preferred embodiment, the piston of the pressure varying device is spring biased away from the conduit, and is actuated by means of compressed air supplied to the side of the piston remote from the conduit and effective to overcome the spring biasing and urge the piston towards the conduit.

Control means whereby the piston is synchron-

ised with the operation of the severing means may take any convenient form, and for example pneumatic and/or electronic control circuitry may be provided. In a preferred embodiment wherein the piston is actuated by compressed air, a switch in a compressed air supply line is coupled mechanically to the drive mechanism for the severing means. In a preferred such embodiment wherein the severing means comprises a closable diaphragm or iris, the drive mechanism comprises a rotatable member coupled to an operating arm of the iris by means of a connecting rod such that rotation of the member causes reciprocating movement of the iris between open and restricted conditions thereof. The rotatable member mounts a cam which is arranged for engagement with the compressed air switch during a predetermined part of the rotation of the member.

In one embodiment, the compressed air switch is connected directly to the compressed air supply line for the piston in which case the desired synchron-isation of the piston with the operation of the iris may be achieved simply by appropriate positional location of the cam on the rotatable member. Alter-natively, the switch may be connected to the piston via suitable pneumatic circuitry whereby the timing and duration of the compressed air thrust supplied to the piston may be varied in a desired manner.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a partially schematic perspective view of apparatus in accordance with the invention;

Figure 2 is an exploded perspective view of part of the apparatus shown in Figure 1;

Figures 3a to *3b* show diagramatically the operating cycle of the apparatus shown in Figures 1 and 2; and

Figure 4 illustrates pneumatic circuitry suitable for use in conjunction with a modified version of the apparatus shown in Figures 1 to 3.

Referring firstly to Figure 1, apparatus for producing discrete ice cream segments comprises a conduit 1 adapted to receive a flow of ice cream pumped from a suitable source (not shown). The conduit 1 includes a downwardly directed outlet duct 2 wherefrom ice cream pieces formed by the apparatus fall under the influence of gravity to be connected e.g. by a conveyor for transporting the pieces to a separate packaging station.

As shown in Figure 2, mounted within the outlet conduit is a severing means in the form of a closable diaphragm or iris which operates in a similar manner to a multi-vane shutter in a camera. Thus, the iris 3 is coupled to a rotatable ring 4 which in turn is rotatably mounted in a plastic spacer disc 5 clamped between upper and lower mounting discs 6, 7. This assembly is in turn bolted to an upper carrying plate 8 which is secured to the outl t conduit. The iris 3 comprises a plurality of individual vanes 9 having upwardly and downwardly projecting pins 10 which cooperate respectively with slots (not shown) provided on the underside of the disc 6 and apertures 11 on the upper surface of the ring 4 in a known manner so that reciprocal rotation of the disc 4 causes the iris 3 to open and close.

As shown in Figure 1, the drive mechanism for the iris comprises a rotatable turntable 12 connected by means of a connecting rod 13 to an arm 14 secured to and projecting radially outwardly from the ring 4. The connecting rod 13 is secured eccentrically to the turntable 12 by means of a pin and slot connection 15 whereby rotation of the turntable 12 by suitable drive means causes reciprocating movement of the iris between desired fully open and restricted conditions thereof. It will be appreciated that the degree of opening and closing and thus the size of the resulting ice cream pieces may be adjusted by varying the length of the connecting rod 13 and the radial position of the connection 15 on the turntable 12.

As shown in Figure 1, apparatus in accordance with the invention further comprises a pressure varying device 16 in the form of a vertically orientated cylinder 17 communicating with the conduit and mounting therewithin a piston 18. A biasing spring 19 is arranged beneath the piston so as to bias the piston upwardly. Compressed air may be fed to the side of the cylinder remote from the conduit 1 by means of a line 20 connected to a compressed air source (not shown) via a pneumatic switch 21. Compressed air supplied to the cylinder 17 is effective to overcome the force of the spring 19 and thus urge the piston 18 downwardly towards the conduit. The pneumatic switch 21 includes an operating member 22 which when depressed is effective to open a valve within the switch 21 and thus supply compressed air to the cylinder. As shown in Figure 1, the turntable 12 forming part of the iris drive mechanism mounts a cam 23 arranged for engagement with the pneumatic switch operating member 21 during part of the rotation of the turntable. Thus, by appropriately locating the cam 23 on the turntable 12, operation of the piston may be synchronised with the operating cycle of the iris in a desired manner.

It will be appreciated that movements of the piston 18 are effective to produce pressure variations within the region of the conduit 1 adjacent the outlet duct. Such pressure variations in turn cause variations in the rate at which ice cream is forced into the outlet duct. Thus, during such time as the piston is being displaced downwardly, there is a relative increase in pressure and the outlet flow of ice cream is increased. Conversely, when the piston is moving upwardly, some ice cream can enter the lower region of the cylinder and there is a relative decrease in pressure and a corresponding reduction in the outlet flow.

As discussed above apparatus in accordance with this invention is particularly suited for forming substantially spherical ice cream pieces, and Figures 3a to 3b illustrate how in this case the piston is synchronised with the iris. The position shown in Figure 3a corresponds to the instant immediately after the iris 3 is in its fully constricted condition. At this point in the cycle the pneumatic switch 22 is in its "off" position and the piston 18 is travelling upwardly under the force of the spring 19.

Accordingly, as shown by the arrows in Figure 3a there is some upward flow of ice cream into the lower part of the cylinder and consequently a relative decrease in pressure within the region of the cylinder adjacent the outlet duct. Thus, the flow of ice cream through the outlet duct is reduced.

As the piston 18 approaches its upper, rest condition shown in Figure 3b which corresponds to the instant immediately before the iris 3 is in its fully open condition, there is a relative increase in pressure within the conduit and a corresponding increase in the outlet flow. At or immediately after the instant where the iris is fully open, the cam 23 engages the operating member 22 of the pneumatic switch such that compressed air is supplied to the cylinder. The effect of this, as shown in Figure 3c, is to cause downward displacement of the piston and a further increase in pressure within the conduit and resulting further increase in outlet flow. As shown in Figure 3d, as the iris 3 returns towards its restricted condition the piston 18 once again moves upwardly so that the pressure and outlet flow are relatively reduced. It will be appreciated that in this way substantially spherical pieces may be produced in that a relatively greater quantity of ice cream is discharged through the outlet duct when the iris is in or adjacent its open condition when the iris is constricted. However, it is envisaged that the piston may be synchronised with the operating cycle of the iris in different ways such that different shapes are obtained. For example, if the down stroke of the piston occurs as the iris is closing, then generally cone shaped pieces are produced.

Other "novelty" effects may also be produced. For example, if the ice cream flow supplied to the conduit consists of two ice cream flavours or colours, and there is an inner flow of one colour surrounded by an outer flow of the other then an "egg" like effect of the resulting ice cream pieces is obtained with one colour completely surrounding the other.

Figure 4 illustrates one form of pneumatic circuitry suitable for use in a modified version of the apparatus shown in Figures 1 to 3; such circuitry provides means whereby the duration of the air pulse supplied to the piston and its timing with regard to the operation of the iris may be varied. Thus, in such a modification upon actuation of the cam operated switch by the cam 23 on the turntable 12, a pneumatic signal is applied to a flip-flop which changes state whereby the mains air supply is applied to pneumatic timers A and B. After a predetermined delay of for example 0.4 to 3 seconds installed by timer A a pneumatic signal is applied to a three part valve C which is thus switched to a condition wherein mains air is supplied to the piston. After a further predetermined p riod of time, set by timer B, a pneumatic signal is supplied to the second input of the flip-flop which is thus re set whereby a resetting signal is applied to valve C so as to shut off the air supply to the piston. It may thus be seen that timer A controls the timing of the air pulse supplied to the piston in relation to actuation of the cam-operated switch, whilst timer B controls the length of the pulse. It has been found to be desirable to employ the modification of Figure 4 particularly when the apparatus is operated at relatively slow speeds.

Whilst certain specific features and broad aspects of apparatus have been described and illustrated, modification may be apparent to those skilled in this art, and the disclosure hereof is intended to encompass any such modification.

CLAIMS

1. Food processing apparatus comprising a conduit arranged in use to receive a flow of bulk foodstuff, such conduit communicating with an outlet duct in or adjacent which is located severing means operable to form the foodstuff passing through the outlet duct into individual pieces thereof, the apparatus further comprising a pressure varying device communicating with the conduit in the region of the outlet duct, such device being actuable in synchronism with the severing means to produce pressure variations within the conduit which are effective periodically to vary the flow rate of foodstuff through the outlet duct.

2. Apparatus as claimed in claim 1 wherein said pressure varying device comprises a cylinder communicating with the conduit and mounting therewithin a reciprocable piston.

3. Apparatus as claimed in claim 2 wherein the piston is spring biased away from the conduit and is actuable by means of compressed air supplied to the side of the piston remote from the conduit.

4. Apparatus as claimed in claim 3 wherein a switch a compressed air supply is coupled mechanically to a drive mechanism for the severing means.

5. Apparatus as claimed in claim 4 wherein said switch is coupled to the piston via pneumatic circuitry whereby the timing and/or length of pressure pulses supplied to the piston may be varied.

6. Apparatus as claimed in any preceding claim wherein the severing means comprises a closable iris.

7. Apparatus as claimed in claim 4 or 5 and in claim 6 wherein the drive mechanism comprises a rotatable member coupled to an operating arm of the iris such that rotation of the member causes reciprocal movement of the iris, such member mounting a cam arranged for engagement with the compressed air switch during a predetermined part of the rotation of the member.

8. Food processing apparatus substantially as herein described with reference to Figures 1 to 3 of the accompanying drawings.

9. Food processing apparatus substantially as herein described with reference to Figures 1 to 3 of the accompanying drawings, modified as shown in Figure 4.

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